California Plant Pest & Disease Report

California Department of Food and Agriculture
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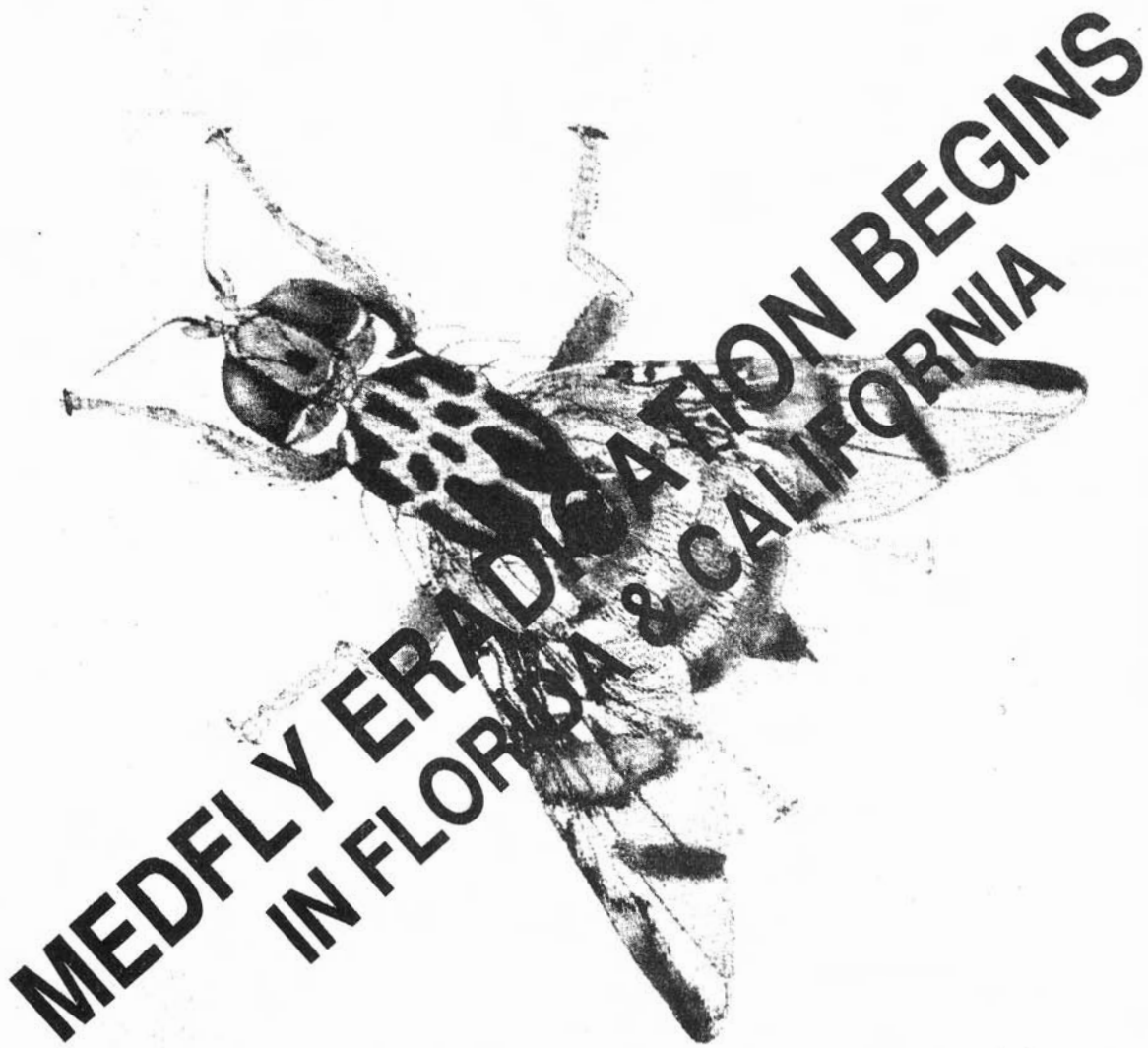

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California Plant Pest & Disease Report

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ENTOMOLOGY HIGHLIGHTS

THE NEW MEDFLY CRISIS

There have been major events involving Mediterranean fruit fly (Medfly) in the United States in 1997. The first event, occurring during the time frame of this CPPDR, happened in Florida. Unfortunately for California, recent finds in Los Angeles and Santa Clara Counties have posed a serious threat to our own Medfly exclusion programs. The California Medfly finds actually happened after the time frame used for this issue of CPPDR, but they will be covered here as part of the overall picture. Both infestations are [in the process of] being eradicated.

SIGNIFICANT FINDS IN FLORIDA

MEDITERRANEAN FRUIT FLY, *Ceratitis capitata*, -(A)- Florida Agriculture Commissioner Bob Crawford announced the finding of a single Mediterranean fruit fly in Tampa, Florida, on May 28, in a Jackson trap baited with trimedlure hanging in a kumquat tree at a residence.

Inspectors with the Florida Department of Agriculture and Consumer Services Division of Plant Industry and United States Department of Agriculture began intensive trapping immediately with the addition of sufficient traps for a total of approximately 1700 fruit fly traps in an 81-square mile zone surrounding the find. Host fruit trees at the residence location and adjoining properties were sampled and examined for larvae.

Fruit fly detection was intensified in the area in accordance with the joint State/Federal Mediterranean Fruit Fly Emergency Program Action Plan which calls for a delimiting survey in the 81-square mile zone radiating from any find. During this survey, 100 additional Jackson fruit fly traps were placed in the one-square-mile core area surrounding the find and would be checked daily; 50 traps per square mile in the one-mile buffer surrounding the core; 25 traps per square mile in the two-mile buffer; 20 traps per square mile in the three-mile buffer; and 10 traps per square mile in the four-mile buffer. Placing the traps was expected to take one week, and any subsequent action will depend on the results of the intensive survey.

By May 30, seven more Mediterranean fruit flies had been discovered during the intensive trapping program that began after the first fly was found in Tampa, May 28. Officials said the second fly, in Brandon, was eight miles from the initial Tampa find. The remaining six flies were found in traps at four sites between the first two finds. With these additional finds, project officials have expanded the area of intensive trapping and assigned additional state and federal agricultural workers to the project.

Medfly has a host range of more than 250 fruits and vegetables, many of which are grown in Florida, including citrus, peppers, and tomatoes.

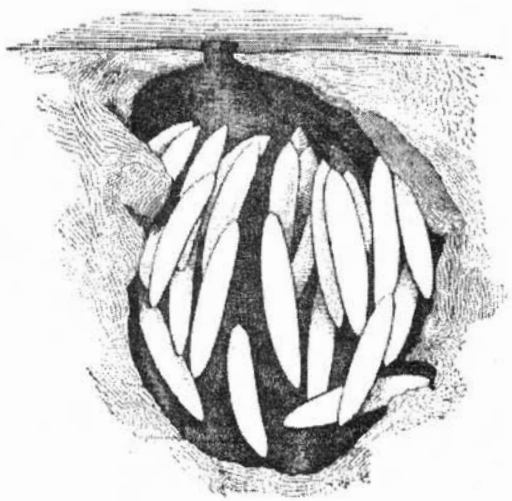
At the time of writing this report, the Florida infestation is nearing successful eradication.

Third instar larvae in plum. Photo by Larry Allen, 1980.

Mediterranean fruit fly, male, showing characteristic position of wings. Courtesy of USDA.

Mediterranean fruit fly, female. Courtesy of USDA.

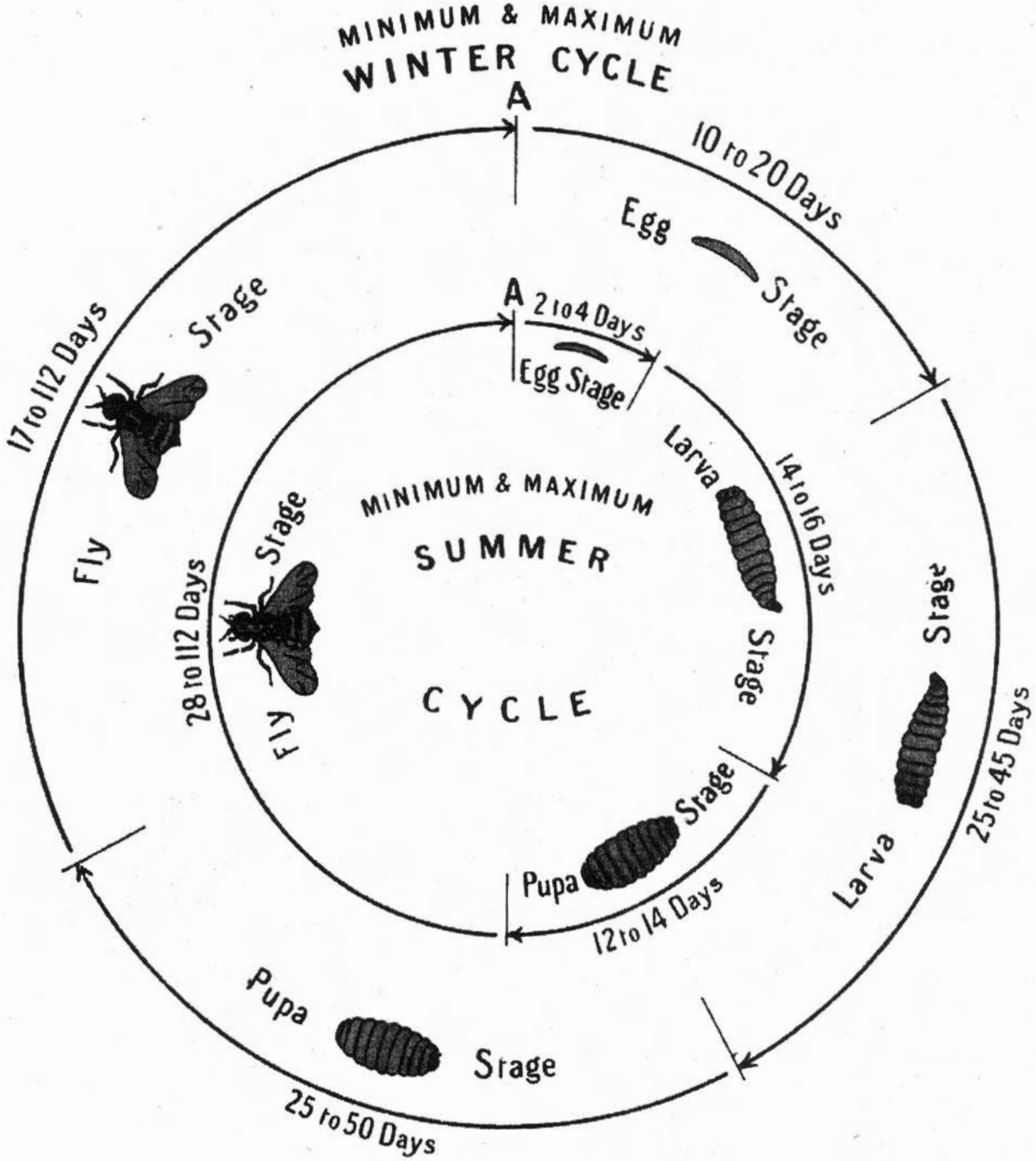
Cross section of a peach, showing the general shriveling of the walls of the egg cavity and the separation of the eggs. E.A. Back & C.E. Pemberton. The Meditrranean Fruit fly in Hawaii. Bulletin No.536. USDA, Washington, D.C. 1918. p. 46.



Section of grapefruit rind, showing two egg cavities, one in cross section. E.A. Back & C. E.. Pemberton. Bulletin 640. USDA, Washington, D.C. 1918. p. 22.

Diagrammatic life cycle.

L. J. Newman. Fruit-Fly Bulletin No. 212. Western Australia, Department of Agriculture. Perth. 1924. p. 18.



CALIFORNIA MEDITERRANEAN FRUIT FLY, *Ceratitis capitata* -(A)- The Medfly find near Los Angeles raised pest eradication concerns in California. Pathways for introduction are being investigated-initially by interviewing homeowners in the area. Elements of the preventative release program also are being reviewed for weaknesses and ways it might need to be strengthened. The finds obviously point to some type of flaw in the sterile release program which was designed to prevent just such an introduction. After the first few finds of Medfly in the Walnut Park area, several blocks apart, a larval survey was started that promptly turned up larvae, indicating an actual infestation in the field.

This triggered an eradication project. The following table lists the recent finds in California up to October 8:

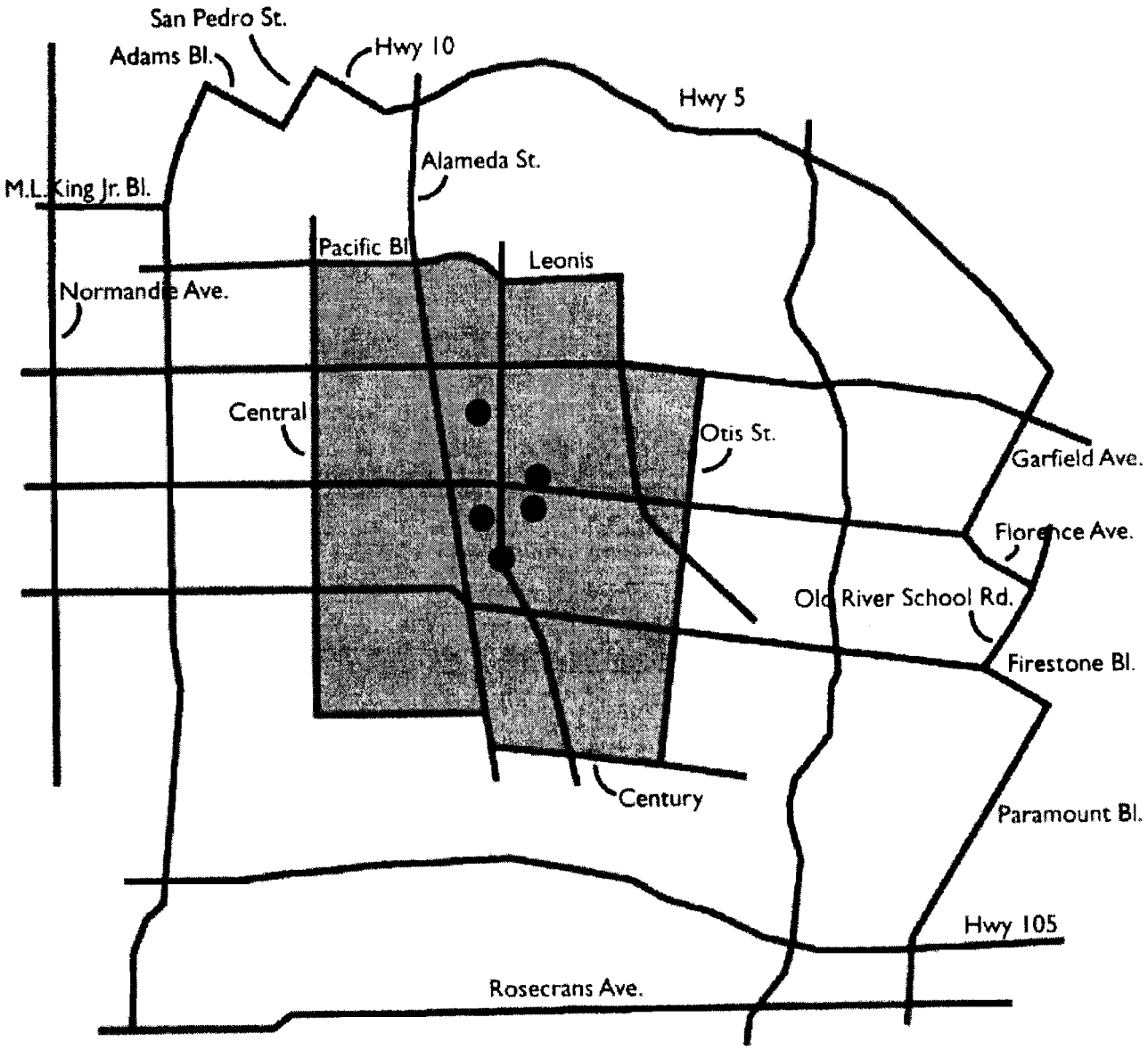
MEDITERRANEAN FRUIT FLY, *Ceratitis capitata* -(A)-

County	City	Date	Host	No. & Sex
Los Angeles	Walnut Park	09/25	peach	1F
Los Angeles	Walnut Park	09/27	grapefruit	1F
Los Angeles	Walnut Park	09/27	guava	2F
Los Angeles	Huntington Park	09/28	grapefruit	1F
*Santa Clara	Milpitas	09/29	apple	1M
Los Angeles	Walnut Park	09/29	guava	1F
Los Angeles	Walnut Park	09/29	orange	4L
Los Angeles	Walnut Park	09/30	guava	3M
Los Angeles	Walnut Park	09/30	guava	1F
Los Angeles	Walnut Park	10/01	guava	1F
Los Angeles	Walnut Park	10/01	guava	2M
Los Angeles	Walnut Park	10/01	guava	3L
Los Angeles	Walnut Park	10/01	Mex. guava	1L
Los Angeles	Walnut Park	10/02	guava	1F
Los Angeles	Walnut Park	10/02	guava	1F
Los Angeles	Walnut Park	10/02	guava	1M
Los Angeles	Walnut Park	10/02	guava	1M
Los Angeles	Walnut Park	10/02	guava	1M
Los Angeles	Walnut Park	10/02	Mex. guava	77L
Los Angeles	Walnut Park	10/03	guava	1F
Los Angeles	Walnut Park	10/03	guava	1F
Los Angeles	Walnut Park	10/03	orange	1F
Los Angeles	Walnut Park	10/04	guava	1M
Los Angeles	Walnut Park	10/04	guava	1L
Los Angeles	Walnut Park	10/06	Mex. guava	1F
Los Angeles	Walnut Park	10/06	guava	7L
Los Angeles	Walnut Park	10/07	Mex. guava	5L
Los Angeles	Walnut Park	10/08	guava	4L
Los Angeles	Walnut Park	10/08	guava	44L
Los Angeles	Walnut Park	10/08	guava	15L
Los Angeles	Walnut Park	10/08	Mex. guava	6L

*no infestation indicated

Walnut Park Medfly Infestation Area

1997 Mediterranean Fruit Fly Eradication Area (shaded grey area)
Trap Finds as of September 30 (black dots)
Walnut Park Medfly Quarantine Boundary (black lines)



New ESA Approved Common Names

The following changes were made in the Entomological Society of America (ESA) common names list in the May 1997, Vol. 20, No. 5, issue of the ESA Newsletter.

Carob moth	*Ectomyelois ceratoniae* (Zoner) LEPIDOPTERA: Pyralidae
Dehli Sands flower-loving fly	*Rhaphiomidas terminatus abdominalis* (Cazier) DIPTERA: Apioceridae
Manzanita leafgall aphid	*Tamalia coweni* (Cockerell) HOMOPTERA: Aphididae
Multicolored Asian lady beetle	*Harmonia axyridis* Pallas COLEOPTERA: Coccinellidae
Trefoil plant bug	*Plagiognathus chrysanthemi* (Wolff) HETEROPTERA: Miridae
Rough strawberry root weevil	*Otiorhynchus rugosostriatus* (Goeze) COLEOPTERA: Curculionidae

NAME CHANGES of NOTE

MARIGOLD THRIPS, *Hydatothrips (Neohydatothrips) samayunkur* (Kudo), was first found in California in 1995 (see CPPDR Vol. 14, No. 3-4:28-29, for more information). The name has been changed to *Hydatothrips (Neohydatothrips) pseudoannulipes* (Johansen). It was found in Australia in 1994 and earlier by Laurence A. Mound. He found that this thrips was previously described as *Neohydatothrips pseudoannulipes* by Johansen in 1983. Since that name was described first, it has priority and *H. samayunkur* is therefore a junior synonym. This information was published by Laurence A. Mound in the Australian Journal of Entomolgy, 1996, 35: 201-202.

A MEALYBUG, The name *Ferrisia consobrina* Williams and Watson has been changed to *Ferrisia malvastra* (McDaniel). The events leading up to this name change have taken a long and convoluted path. Back in the 1960s, a mealybug then called the striped mealybug, *Ferrisia virgata* (Cockerell), was found infesting cactus and other ornamentals in Imperial County. The mealybug was put under an eradication project at that time. The project was unsuccessful, partly because it was discovered that the species would go down to the roots of the host at certain times of the year, making survey for the pest difficult.

Later in the 1970s, during the campaign against the Comstock mealybug in the San Joaquin Valley, Dr. Dan Moreno, then at the USDA Boyden Research Laboratory at U.C. Riverside, was experimenting with trapping techniques for male mealybugs using pheromones produced by the females. Simultaneously, Dr. Robert Flock, Entomologist for Imperial County, noticed a population, apparently of striped mealybug, which was attacking a commercial citrus grove near Calexico. This behavior was totally different than the previous behavior of striped mealybug in the El Centro area where it had ample opportunity to attack citrus. Attempts in this lab to separate two species out of this complex of things was not possible at that time because the large amount of variability in the morphological characteristics was not understood.

The species called *Ferrisia virgata* was known from the literature to produce males, so Dan Moreno requested a colony from Bob Flock, which was supplied from the El Centro population. This population turned out to be parthenogenetic, no males being produced at all. A submission of the Calexico citrus population did indicate that males were produced in very large numbers in that population. So obviously there was a very major difference in the biologies between the two populations, and shortly thereafter characters were discovered that separated them adequately.

Other mealybug specialists around the world were also involved in similar stories dealing with the *Ferrisia* complex. In 1988, Williams and Watson, in their treatise on the mealybugs of the South Pacific, described the El Centro cactus-feeding species as *consobrina*. The Calexico citrus-feeding species was the true *Ferrisia virgata*. At the time they described *consobrina*, Williams and Watson suggested that it may be a synonym of *Ferrisia (Heliococcus) malvastrum* McDaniel, but the type specimens were not available for study. Since that time the types have been located, and *consobrina* is in fact a synonym. The information on this synonymy was published in The Entomologist's Monthly Magazine, Vol. 132:1-10 (1996).

The approved ESA common name of *Ferrisia virgata* is the "striped mealybug." There is no approved common name for *Ferrisia malvastra*, but malvastrum mealybug would be a good choice for the future.

CAROB MOTH, *Ectomyelois ceratoniae* (Zoner) (see common names list on page 8) was formerly listed by this Department as *Spectrobates ceratoniae* but we are now using the current accepted generic name of *Ectomyelois*.

SIGNIFICANT FINDS

MEXICAN FRUIT FLY, *Anastrepha ludens*, -(A)- Two Mexican fruit flies were found during the period of this report. The first fly was captured in East Los Angeles, **Los Angeles** County, by Gorman on February 24, 1997. The second fly was trapped in a tangerine tree on March 24, 1997, in Ramona, **San Diego** County by Vanarelli.

SWEET POTATO WEEVIL, *Cylas formicarius elegantulus*, -(A)- As a result of a delimitation survey in **San Diego** County, sweet potato weevils have been detected in new areas. Sweet potato weevils were first detected December 21, 1996, in a field near San Diego (for more information, see last CPPDR 15(5-6):158). The weevils since have been found in home gardens and small commercial fields, in addition to the original find. In response, all surface vegetation was removed, the field was rototilled and then tarped to destroy any remaining weevils through solarization. Sweet potato weevil traps have been placed in Los Angeles, Riverside, Orange, San Bernadino and Ventura Counties. Although May may be too early, as soon as host plants, including sweet potatoes and morning glories, are located, traps will be placed in Bay Area counties. For more information on sweet potato weevils, see CPPDR 12(1-2):3-8.

Tests using *Heterorhabditis* nematodes were initiated in May by Clinton Campbell of CDFA. This particular strain of nematodes was isolated from sweet potato weevils in the Caribbean area. Previous field tests using *Steinernema* nematodes were inconclusive. Campbell has also been dissecting bindweed from isolated sites with high sweet potato weevil counts and has

taken 9 larva and numerous eggs from the bindweed. Finding breeding weevils in native host plants will complicate control efforts.

In the Southern District, a total of 1,776 sites have now been sampled at least once with a total of 579 traps in service over an area of 225 square miles. Fifty two unique grids are now considered infested. Weevils have been found thirteen miles apart going from east to west and twenty miles apart going from south to north. The extent of the infestation in field bind weed and its absolute isolation makes us question both our eastern boundary and any assumptions we have made about the age of this infestation. Based on a two or three hundred meter annual expansion rate, we should probably be measuring the age of this infestation in decades instead of years. The isolated mountain community of Jamul should now be considered completely and seriously infested. To date, all weevil finds have been in field bind weed only.

In the Van Nuys area, during the week of May 16, 50 of 51 traps were inspected. A missing trap was replaced. Five aditional relocations took place. 171 total sites are now surveyed and cover 32, square-mile grids. No infestations were found in the LA area.

TWO SPOTTED LEAFHOPPER, *Sophonia rufofascia*, -(Q)- First found in California in 1996 (See CPPDR 15(1-2):4-5, 6-7), this leafhopper has since begun to expand its range very rapidly. If its economic importance in Hawaii is any indication, we can expect to see some serious problems with the species in the the future here in the State. The following list indicates the known distribution of the species:

City	County	Date	Host	Situation	Collector
Carpinteria	STB	3/31/95	*Rhapis kentia*	Nursery	Squires
San Diego	SDO	4/9/95	carrotwood	Field	Kellum/Rendon
San Juan Capistrano	STB	1/7/96	*Howea forsteriana*	Nursery	Bennet
Rosemead	LAX	2/28/97	magnolia	Nursery	Sium
Carpinteria	STB	2/29/96	*Phoenix roebelenii*	Nursery	Squires
Commerce	LAX	4/1/96	*Psidium*	Nursery	Sium
South Gate	LAX	6/24/96	*Psidium guajava*	Nursery	Sium
San Gabriel	LAX	10/23/96	*Tristania* sp.	Nursery	Sium
San Gabriel	LAX	11/8/96	*Psidium guajava*	Nursery	Sium
Encinitas	SDO	11/8/96	*Sollya heterophylla*	Field	Kellum
San Juan Capistrano	STB	12/26/96	*Howea forsteriana*	Nursery	Bennet
Carpinteria	STB	3/3/97	*Persea americana*	Field	Davidson
South Gate	LAX	4/21/97	*Viburnum gystas*	Nursery	Sium
Commerce	LAX	6/23/97	*Eriobotrya japonica*	Nursery	Humphreys
San Gabriel	LAX	7/22/97	magnolia	Nursery	Humphreys
Garden Grove	ORA	7/23/97	panel trap	Field	Delgado
Huntington Beach	ORA	7/25/97	panel trap	Field	Gomez

AFRICANIZED HONEY BEE (AHB), *Apis* "Africanized," -(A)- This table lists the finds made during the period of this report:

County	City	Date	Host	Collector
Imperial	El Centro	03/10	Cardboard box	Hodgkin
Imperial	Holtville	04/07	Water meter box	Weathersby
Imperial	Holtville	04/06	Tree	Hodgkin
Imperial	Calexico	04/02	Trap	Mecate
Imperial	El Centro	04/02	Tree-base	Palomera
Imperial	Westmorland	03/24	Check gate	Palomera/Inay
Imperial	El Centro	04/07	Water meter box	Palomera
Imperial	Imperial	04/06	Fence	Hodgkin
Imperial	El Centro	03/20	Tree	Inay
Imperial	El Centro	03/20	*Citrus paradisi*	Palomera
Imperial	El Centro	04/29	Cardboard box	Hodgkin
Imperial	El Centro	04/01	Swarm in tree	Ray
Imperial	Calexico	04/01	Swarm in tree	Inay
Imperial	Heber	04/01	Swarm in tree	Inay
Imperial	El Centro	04/01	Swarm in tree	Estrada
Imperial	Heber	04/01	Swarm on hay bale	Estrada
Imperial	El Centro	04/01	House-roof	Estrada
Imperial	El Centro	03/20	*Eucalyptus* sp.	Palomera
Imperial	Calexico	03/26	*Morus* sp.	Weathersby
Imperial	El Centro	03/24	Swarm on tree	Hodgkin/Ray
Imperial	Calipatria	03/24	Swarm on power pole	Hodgkin
Imperial	Calexico	03/25	Swarm in tree	Weathersby
Imperial	Holtville	03/06	Swarm in bush	Hodgkin
Imperial	Calexico	03/07	Swarm in tree	Estrada
Imperial	Brawley	03/08	Swarm in palm tree	Estrada
Imperial	El Centro	03/09	Swarm in lemon tree	Estrada

SIGNIFICANT FINDS OTHER STATES

AFRICANIZED HONEY BEE, *Apis* "Africanized" -(A)- Arizona has had it's third AHB human fatality. A 73 year old man in Casa Grande died from multiple bee stings. Information on the incident is lacking due to the non-involvement of the Arizona Department of Agriculture.

BOLL WEEVIL, -(A)- Ted Boratynski, USDA, reported that a boll weevil was trapped in the Mexicali Valley during the last week of April. The site is about 30 miles southeast of Mexicali, 20 miles southwest of Algodones, Mexico; and 10 miles west of San Luis, Arizona.

Under contract with CDFA, the Imperial County Agricultural Commissioner maintains a year-round trapping program for boll weevil. No boll weevils have been trapped in California since 1990.

MEDITERRANEAN FRUIT FLY, *Ceratitis capitata*, -(A)- A single Mediterranean fruit fly was found in Tampa, Florida, on May 28, in a Jackson trap baited with trimedlure hanging in a kumquat tree at a residence. See story on page 3.

NEW STATE RECORDS

BOUGAINVILLEA MITE, *Phyllocoptes bougainvillaea*, -(C)- This mite has been found in Santa Barbara, **Santa Barbara** County, on bougainvillea plants. It is the first record for California and probably the U.S. Gerry Davidson, Santa Barbara County Entomologist, made the find in a nursery on December 17, 1996. This mite was determined by Dr. J.A. Amirine, an eriophyid mite specialist from Morgantown, WV. The mite was originally collected and described from Campinas, Brazil, in 1959, on *Bougainvillea spectabilis* Willd (Nyctaginaceae), bougainvillea. Damage to the host consists of extensive leaf rolling from the underside. Delimitation surveys by Gerry Davidson show that the mites now occur in several non-nursery locations in and around Santa Barbara. The find comes at a bad time because many new colors and varieties of bougainvillea have recently caused increased interest and use of these plants in the landscaping industry.

AN AUSTRALIAN EUCALYPTUS BEETLE, *Phoracantha recurva*, -(Q)- On June 24, 1995, twelve specimens of the Australian cerambycid beetle were found in the U. C. Riverside laboratory colony of the closely related eucalyptus longhorned borer, *P. semipunctata*. Although *P. recurva* has colonized many parts of the world in association with *P. semipunctata*, this was the first time that it had been found in North America. Please turn to page 17 for a detailed report on this insect.

Comparison of two species of Eucalyptus borers found in California:

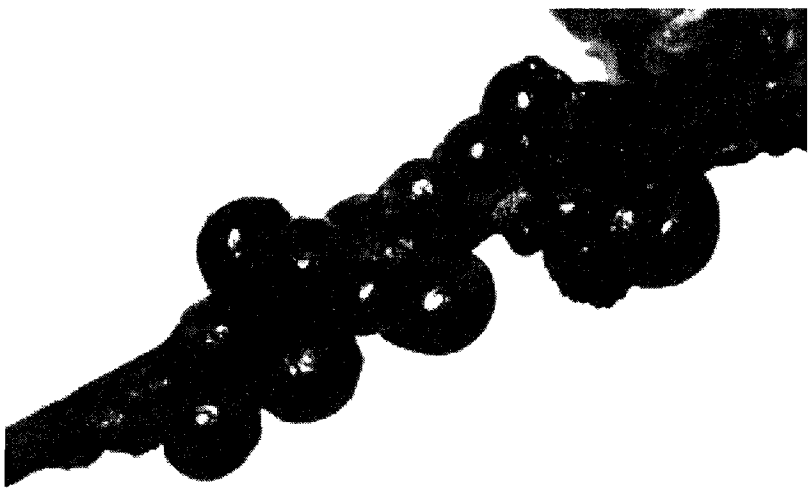
Phoracantha recurva Newman	*Phoracantha semipunctata* (Fab.)
Basal elytral dark band narrow, restricted to anterior margin medially, extending for a short distance behind scutellum and to basal third behind humerus, the latter marking sometimes broken into a basal stripe and distal marking; distal pattern at basal third consisiting of a small irregularly shaped marking on each side of the elytron.	Basal elytral dark band expanded well beyond tip of scutellum, zigzag marking at basal third often joined laterally and along suture with basal band, enclosing three irregularly shaped pale areas on each elytron.
Spine on third antennal segment curved.	Spine on third antennal segment straight.
Hind femor with strong spines on distal one-half of anterior edge.	Hind femor uniformly clothed with a mixture of short pale recumbent and longer golden hairs, spines absent.
Antenna with long, dense golden hairs on the underside of each segment (most pronounced in the male).	Antenna with short, sparse golden hairs on the underside of each segment.
Currently known fromLos Angeles, Riverside, Orange and San Bernadino Counties.	Currently known to occur in the following 17 counties: Alameda, Contra Costa, Fresno, Los Angeles, Monterey, Napa, Orange, Sacramento, San Bernardino, San Diego, San Joaquin, San Mateo, Santa Barbara, Santa Clara, Solano, Sonoma and Ventura.

NEW COUNTY RECORDS

AN AVOCADO THRIPS, *Scirtothrips* sp.,-(Q)- This thrips was found on avocado **in two new counties** by Dr. Mark Hoddle of U.C. Riverside. The first find was in Corona, **Riverside** County on April 23 and the second was on May 16 at Escondido, **San Diego** County. This thrips is also found in the counties of **Ventura, Los Angeles, Orange, San Luis Obispo,** and **Santa Barbara.** It was first found in California in 1996 in avocado orchards in **Ventura** County, where it was causing severe premature fruit drop. For more information, see CPPDR, 15(1-2):4. The species will be officially described probably by the end of the year by Steve Nakahara, with the Systematic Entomology Laboratory in Beltsville, MD.

BAILEYANA PSYLLID, *Acizzia acaciae-baileyanae,* -(C)- This psyllid was found on an acacia tree in **Riverside** County by M. Lahti on May 13, 1997. For more information on the Baileyana psyllid, see CPPDR, 6(1-2): 6-7.

KUNO SCALE, *Eulecanium kunoense,* -(B)- This scale was found April 7, on an ornamental cherry planting in a shopping mall parking lot in **Solano** County by Kathlene Casanave. Adult females are almost spherical, 3-4 mm in diameter and resemble rows of B-Bs glued to the stems of the host. A useful identification characteristic is the broad internal "lip" of the body margin which occurs where the adult female scale attaches to the host; best seen by removing the females from the host and examining the venter. For most of the year females are a dark, shiny, chestnut brown, with numerous darker depressed spots. For a short time, before egg laying begins in the spring, adult females are yellowish with 7-8 transverse black bands or partially coalescing black blotches and a diffuse median longitudinal stripe of red or orange. Nymphs are flat, yellow or brown, covered with large angular wax plates and with a fringe of marginal wax. Males are prevalent, with a cover or test of transparent crystalline wax, 2.0 mm long and divided into 7 plates by bands of curled strands of white wax.



Lecanium kunoensis on flowering plum

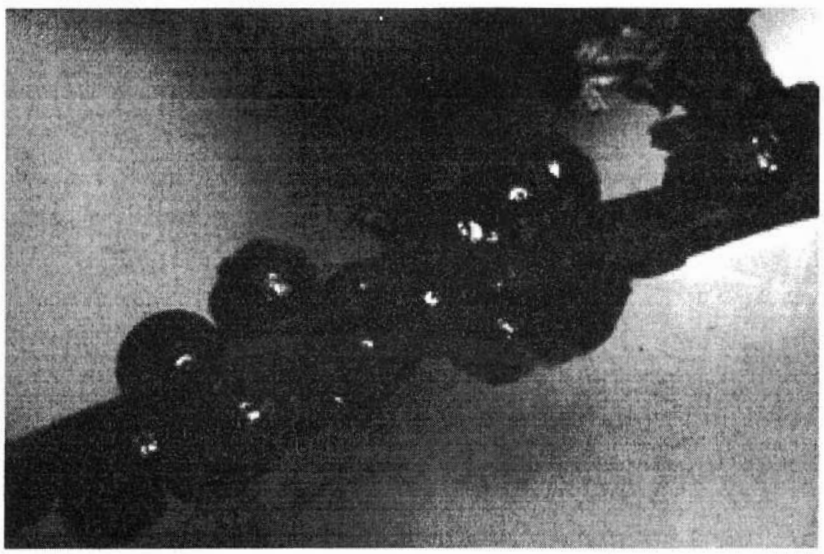
There is only one generation per year in California. Beginning sometime in March through early May, crawlers migrate to the leaves, nymphs develop on the leaves during summer and return to the twigs before leaf drop in the fall.

In the field, the broad ventral internal lip of the adult female distinguishes this soft scale from other soft scales. Immature stages cannot be separated from other scales in the genus *Eulecanium*. Pyracantha and plum are the preferred hosts but walnut and most fruit trees in the rose family can become infested.

Kuno scale is not a pest of commercial crops in California although it has that potential. Populations can enlarge rapidly, producing copius amounts of honey-dew. Biological control attempts have not been successful so far.

It was introduced from the Orient, possibly around 1896. Up until now, it was found only in **Santa Clara, Alameda, Contra Costa, Lake, Napa, Butte** and **Sacramento** Counties.

Morphologically distinct from all other North American soft scales except *Eulecanium tiliae*, Kuno scale has more marginal setae; fewer multicolor disc pores; many large dorsal discoidal pores; only 2 spiracular setae in each spiracular depression and lacks anal ring setae.



Lecanium kunoensis on flowering plum

ERRATA

MEDITERRANEAN FRUIT FLY, *Ceratitis capitata* , -(A)- The medfly listed in CPPDR, 15(3-4): 73, was a very dried specimen. It was determined to have come from a trap that had been tampered with. Additonal trapping revealed no other specimens. Clearly, this incident did not indicate the presence of an infestation.

EXCLUSION

The following pests of significance were intercepted in quarantine situations during the period of this report:

BROWN CITRUS APHID, *Toxoptera citricida*, -(Q)- Brown citrus aphid (BCA), which damages citrus, was recently intercepted in a nursery shipment from Hawaii with a destination of Orange County. The aphid was found in a shipment of cut *Dracaena* and *Anthurium*. While this was probably not the host, the aphid was alive and could have easily moved onto other hosts here in California. Hawaii and Florida are the only states where BCA is known to occur. BCA is known to transmit severe strains of citrus tristeza virus as well as directly damage leaf tips and flowers.

About 175 citrus growers and nurserymen were briefed by then Division Director Isi Siddiqui on March 27, about the status of BCA. The Unveristy of California at Riverside and the Citrus Research Board jointly organized the meeting. Dr. Siddiqui summarized the conclusions of the BCA Task Force, appointed by the Department in 1993. The Task Force's report had concluded that the BCA would eventually arrive in California and could not be eradicated. The use of management strategies, especially the release of biological control agents, was recommended.

At the request of the Citrus Research Board and the California Citrus Quality Council, an interagency working group on BCA is in the process of being appointed by the Department. For more information on the biology and economic importance of brown citrus aphid, see CPPDR 15:(5-6) 160-61 and 11:(1-2) 11-14.

SANSEVIERIA SCALE, *Parlatoria proteus*, -(A)- Collected in a Ripon, **San Joaquin** County, nursery on February 13 by Robert Pelletier. The host was *Dracaena sanderana*.

PICKLEWORM, *Diaphania nitidalis*, -(B)- Collected in **San Mateo** County February 2 by Mark Conover. The host was *Cucurbita* sp.-spaghetti squash, purchased at a local supermarket.

MEALYBUG, *Nipaecoccus* sp., -(Q)- This undescribed species of mealy bug was collected by Mark Nestor from a nursery in Stanton, **Orange** County, on March 3. The host was a bromeliad.

Some of the more unusual "A", "B" and "Q" rated pests intercepted in quarantine during the time frame of this CPPDR are listed on the next two pages.

"A", "B", and "Q" Rated Arthropods and Mollusks Intercepted in Quarantine January 1997 - May 1997

Rating	Species	Common Name	Date	Origin	County	Host	Collector(s)
A	*Anastrepha* sp.,	exotic fruitfly	1/10	Puerto Rico	LAX	fruit	Nolan
Q	*Sybra alternans*	longhorned beetle	12/18/96	Hawaii	ORA	*Dracena* sp.	Wynn
A	*Pseudococcus cryptus*	mealybug	12/23/96	Hawaii	LAX	*Heliconia* sp.	Barnes
Q	*Rhizoecus hibisci*	root mealybug	12/27/96	Hawaii	ORA	*Rhapis* sp.	Wynn
Q	*Dallasiellus sp.*	negro bug	2/13	Ecuador	LAX	*Musa* sp.	Canales
Q	*Hemiberlesia ocellata*	armored scale	2/18	Ecuador	LAX	*Musa* sp.	Bowman
Q	*Dysdercus* sp.	stainer	2/13	Ecuador	LAX	*Musa* sp.	Canale
Q	*Pseudaonidia trilobitiformis*	trilobe scale	2/5	Florida	SJQ	*Ficus benjamina*	Lanchester
Q	*Hortensia similis*	sharpshooter	2/11	Costa Rica	SJQ	*Dracaena* sp.	Lanchester
Q	*Inglisia vitrea*	soft scale	2/4	Florida	ORA	*Syzygium samarengense*	Nestor
Q	*Milviscutulus mangiferae*	mange shield scale	2/6	Florida	ORA	*Mangifera indica*	Park
Q	*Aleurocanthus woglumi*	ctrus blackfly	2/25	Florida	SFO	*Citrus* sp.	Sohal/Wion
A	*Chrysomphalus propsimus*	armored scale	2/25	Hawaii	ORA	*Howea forsterana*	Barnes
Q	*Freysuila caesalpiniae*	psyllid	2/4	Arizona	RIV	*Caesalipinia cacaloco*	Shaffer
A	*Toxoptera citricida*	brown citrus aphid	2/12	Hawaii	ORA	*Cordyline* sp./*Anthurium* sp.	Barnes
Q	*Selenaspidus articulatus*	rufous scale	3/4	Ecuador	LAX	*Musa* sp.	Ortega
Q	*Malleolaspis* sp.	armored scale	3/12	Florida	BUT	palm	Hill
A	*Parlatoria proteus*	sansevieria scale	3/12	Costa Rica	SJQ	*Dracaena sanderana*	Pelletier
A	*Parlatoria proteus*	sansevieria scale	3/12	Costa Rica	SJQ	*Dracaena sanderana*	Pelletier
Q	*Coccus acutissimus*	slender soft scale	3/19		SBA	*Cycas revoluta*	Davis
Q	*Aleurotrachelus* sp.	whitefly	3/17	Hawaii	SCL	*Piper lolot*	Nachand
Q	*Bambusaspis robusta*	robust bamboo pit scale	3/13	Hawaii	ORA	*Bambusa vulgaris*	Fernandez
Q	*Liriomyza* sp.	leafminer fly	3/17	Hawaii	SCL	*Ocimum basilcum*	Nachand
Q	*Pseudococcus landoi*	mealybug	3/14		SJQ	*Dracaena marginata*	Lansigan
A	*Selenaspidus articulatus*	rufous scale	3/19	Ecuador	LAX	*Musa* sp.	Morris
A	*Parlatoria proteus*	sansevieria scale	3/20	Guatemala	SJQ	*Dracaena sanderiana*	Lansigan
B	*Pseudococcus elisae*	elisa mealybug	3/21	Costa Rica	SJQ	*Dracaena marginata*	Lansigan
A	*Orgyia leucostigma*	whitemarked tussock moth	4/11	Florida	SAC	tree fern-cut	Bianchi
Q	*Acleris* sp.	leafroller	4/3	Florida	SFO		Wion
Q	*Atractomorpha ambigua*	grasshopper	3/31	Hawaii	LAX	herbs	Chinwah
Q	*Diaspis* sp.	armored scale	4/3	Florida	SFO	*Bromeliaceae*	Wion
Q	*Oxydema* sp.	weevil	3/12	Hawaii	LAX	*Zingiber* sp.	Hamashita
Q	*Retithrips syriacus*	black vine thrips	4/3	Florida	SFO		Wion
Q	*Tetranychus* sp.	tetranychid mite	4/2	Hawaii	SON	*Dendrobrium nobile*	Raney
Q	*Palmicultor* sp.	mealybug	5/7	Florida	ORA	*Wodyetia bifurcata*	Fernandez
Q	*Philomycus* sp.	slug	5/12	Hawaii	SBA	*Cordyline terminalis*	Davis

Rating	Species	Common Name	Date	Origin	County	Host	Collector(s)
Q	*Pinnaspis uniloba*	unilobed scale	5/14	Hawaii	ALA	*Alyxia olivaeformis*	Seslowe
B	*Pulvinaria urbicola*	urban soft scale	5/29		SMT	*Masdevallia* sp.	Loux
Q	*Aleurocerus palmae*	palm whitefly		Washington	SAC		
Q	*Coccus acutissimus*	slender soft scale	4/22	Hawaii	LAX	*Cycas revoluta*	Hamashita
Q	*Crenidorsum* sp.	whitefly	4/18	Hawaii	SBA	*Philodendron* sp.	Davis
Q	*Rhizoecus hibisci*	root mealybug	4/22	Florida	ORA	*Ravenea ribularis*	Fernendez
A	*Hemiberlesia palmae*	tropical palm scale	5/2	Florida	SBA	bromeliad	Davis
A	*Palatoria proteus*	sansevieria scale	4/30	Costa Rica	SJQ	*Dracaena sanderana*	Pelletier
Q	*Brachymyrmex* sp.	ant	4/16	Ecuador	LAX	*Heliconia* sp.	Chinwah
B	*Diaphania nitidalis*	pickleworm	4/14	Guatemala/FL	SFO	yellow zucchini	Lino
B	*Dysmicoccus alazon*	alazon mealybug	4/9	Florida	ORA	*Ficus benjamina*	Wynn
Q	*Euxesta stigmatias*	corn silk fly	4/22	Mexico	SCL	*Zea mays*	Meyer
Q	*Megaselia seticauda*	scuttle fly	4/22	Mexico	SCL	*Zea mays*	Meyer
Q	*Rhizoecus hibisci*	root mealybug	4/8	Florida	ORA	*Ravenea* sp.	Fernandez
Q	*Coccus acutissimus*	slender soft scale	4/15	Florida	ORA	*Dimocarpus longan*	Nestor
A	*Parlatoria proteus*	sansevieria scale	4/17	Costa Rica	SJQ	*Darc sandrea*?	Pelletier
Q	*Tetranychus* sp.	tetranychid mite	4/15	Mexico	SFO	plant	Chehrezad
Q	*Oxydema longula*	weevil	3/26	Hawaii	LAX	flowers-cut	Awad
A	*Pseudoparlatoria parlatorioides*	false parlatoria scale	4/1	Ecuador	LZX	*Musa* sp.	Fitterer

BORDER STATIONS

The following list includes a select few of the more interesting or unusual discoveries made by border station personnel. In the wake of the medfly infestation in Los Angeles County, a list of fruit flies intercepted at the border stations is included at the end.

PEST	STATION	DATE	ORIGIN	HOST
Zebra mussel				
Dreissena polymorpha	TR	1/97	Lorain, OH	33' Chriscraft
Arrowhead scale-found on citrus 29 times				mostly oranges
Unaspis vanonensis	DO (2)	1/97	China (17)	
	HO (27)		Japan (8)	
			Australia (1)	
			Florida (1)	
			Unknown (2)	
Longan scale-found 13 times				
Thysanofiorinia nephelii	HO (11)	1/97	Taiwan (some)	Longans
	YE (2)			
Vanda orchid scale-found 33 times				
Genaparlatoria pseudaspidiotus	DO (1)	1/97	Mexico (11)	mostly mangoes
	HO (18)		Brazil (1)	
	NE (1)		Guatemala (1)	
	SM (6)		Unknown (20)	
	VI (5)			
	YE (2)			
FRUIT FLIES:				
Walnut husk maggot-live larvae				
Rhagoletis suavis	MO (2)	2/97	KS, KY, PA	Walnuts/husks
Walnut husk maggot-live larvae				
Rhagoletis suavis		4/97	AR, KS, NC	Walnuts/husks
Apple maggot-live larvae				
Rhagoletis pomonella		4/97	OR (2), WA (1), OH (1)	Apples
Apple maggot-live larvae				
Rhagoletis pomonella		4/97	OR (4),	Pears
Apple maggot-live larvae				
Rhagoletis pomonella		4/97	OR, Canada	Plums
Caribbean fruit fly-live larvae				
Anastrepha (prob) *suspensa*		2/97	FL	Grapefruit
Caribbean fruit fly-live larvae				
Anastrepha (prob) *suspensa*		2/97	FL (2)	Grapefruit
Western cherry fruit fly-live larvae				
Rhagoletis pomonella		2/97	PA	Cherries
Western cherry fruit fly-live larvae				
Rhagoletis pomonella		2/97	WA, UT	Cherries
Eastern cherry fruit fly-live larvae				
Rhagoletis cingulata		2/97	WA, UT	Cherries
Medfly-dead larvae				
Ceratitis capitata		2/97	Spain (5 shipments)	Tangerines
Exotic fruit fly-dead larvae				
Anastrepha sp.		2/97	Mexico	Mangoes
Exotic fruit fly-dead larvae				
Bactrocera sp.		2/97	Taiwan	Carambolas

ANOTHER TREE-KILLING PEST OF EUCALYPTUS INVADES CALIFORNIA

Lawrence M. Hanks[1,2], Timothy D. Paine[1], Jocelyn G. Millar[1], and Chris Campbell[1]

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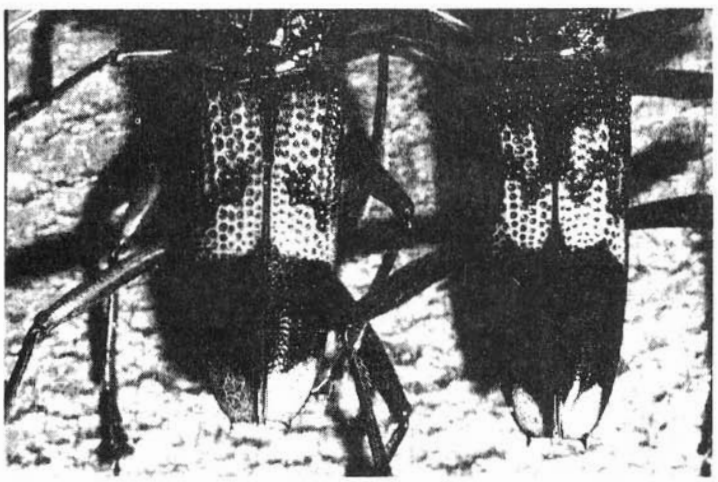
On June 24, 1995, twelve specimens of the Australian cerambycid beetle *Phoracantha recurva* were discovered in our laboratory colony of the congeneric eucalyptus longhorned borer, *P. semipunctata*, at UC Riverside. Although *P. recurva* has colonized many parts of the world in association with *P. semipunctata* (Drinkwater, 1975), this was the first time that it had been found in North America. Specimens were submitted to CDFA and the species identification was confirmed (Wang, 1995).

Both *Phoracantha* species are indigenous to Australia, and both kill large numbers of trees in other regions of the world where eucalyptus has been introduced (see Hanks et al., 1993). *P. semipunctata* was first reported in California in 1984 (Scriven et al., 1986), followed by its rapid spread throughout the southern portion of the state (Paine et al., 1995), and more recently into the San Francisco Bay Area and as far north as Shasta County.

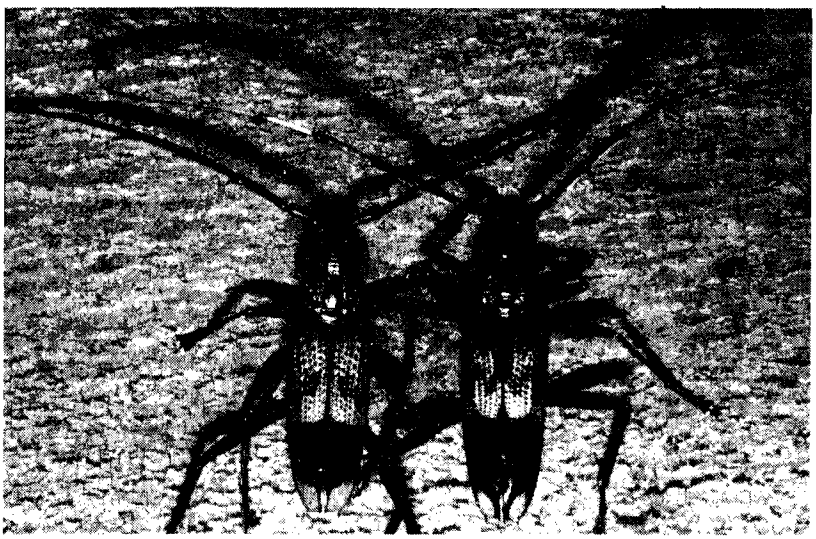
Phoracantha recurva closely resembles *P. semipunctata*, both beetles being about 1.2 to 2.5 cm in length, with the very long antennae (~1.1 to 1.4 times body length) characteristic of the Cerambycidae. The base color of both beetles is dark brown, with cream to yellowish patches in clearly defined patterns. The two species can be differentiated with readily identifiable characters. First, the elytra (wing covers) of *P. semipunctata* are mostly dark brown with a central band of cream color that is bisected by a brown zigzag line. In contrast, the elytra of *P. recurva* are mostly cream colored, with dark brown areas limited to the lower one third and, in some individuals, a thin band of brown at the base of the elytra where they are attached to the body of the insect (see photo). Second, *P. recurva* have dense golden hairs along the



Closeup of the elytra (wing covers) of *Phoracantha semipunctata* and *P. recurva*. The elytra of *P. semipunctata* are primarily dark brown, with a zigzag brown line bisecting the cream-colored patch in the middle of the elytra. For *P. recurva* in contrast, the base color of the elytra is cream to yellowish, with dark brown areas limited primarily to the lower third of the elytra, with some individuals having a thin line of brown where the elytra join the body.

antennae; these hairs are absent in *P. semipunctata*. Both species readily attack and kill stressed or diseased eucalyptus trees, especially those under drought stress (Hanks et al., 1995).

The two *Phoracantha* species also appear to be similar in behavior and biology. Adult beetles are attracted to stressed trees, freshly cut eucalyptus logs, or fallen branches, where they mate and the females deposit batches of spindle-shaped, yellowish eggs in bark cracks or under exfoliating bark (see Hanks et al., 1993). Eggs hatch in several days, and neonate larvae bore



Adult *Phoracantha semipunctata* (left) and *P. recurva* (right).

through the bark and feed along the cambium beneath the bark leaving meandering mines packed with their sawdust-like excrement. Destruction of the cambium by larval feeding can kill a tree in a matter of a few weeks. Trees under attack typically show wilting and drying of the foliage, with dried leaves remaining on the tree. As the infestation progresses, the bark dries and may crack with larval excrement leaking from the cracks. Crunching sounds of the feeding larvae are easily heard by listening carefully near the trunk.

When larvae have reached their maximum size, after about 6-8 weeks of feeding, they bore into the sapwood and construct a pupation chamber where they complete their development. During the summer, larvae pupate and emerge as adults within a few weeks; however, during the cooler months larvae will become quiescent, delaying pupation and further development until temperatures warm up in spring. Thus, egg to adult development requires about 8-12 weeks during the summer, but can be longer than 6 months for overwintering larvae.

P. recurva emerged in our cages, along with *P. semipunctata*, from eucalyptus logs originating from Riverside County. Although *P. recurva* may have been present in California previous to 1995, examination of several hundred preserved specimens captured on eucalyptus logs with sticky cards at sites around southern California between 1992 and 1994 revealed that all were *P. semipunctata*. To date, ongoing monitoring studies in southern California have yielded specimens of *P. recurva* in Riverside, San Bernardino, Orange, San Diego, and Los Angeles Counties. Work is currently in progress to delineate the current range and spread of this pest.

Relative abundance of *P. recurva* versus *P. semipunctata* in Riverside Country has risen sharply since 1995; of 80 beetles captured on sticky cards placed on eucalyptus logs in three locations during summer 1997, 57 (71%) were *P. recurva* and the rest *P. semipunctata*. The proportion of *P. recurva* emerging from caged eucalyptus logs (originating from Riverside County) has also increased dramatically, with 59 *P. recurva* out of 4,138 beetles (1.4%) emerging during summer 1996 compared to 2,852 *P. recurva* out of 3,843 beetles (74%) during 1997. One dead tree felled on the UC Riverside campus in summer 1997 produced more than 1,700 *P. recurva* and not a single *P. semipunctata*.

Absence of *P. recurva* from beetle samples taken before 1995 and evidence of subsequent rapid population growth suggest that this species colonized California recently. *P. recurva* may already be the dominant eucalyptus-boring species in some areas, because it appears to emerge earlier in the spring and is active until later in the fall, and it has a shorter egg-adult development period than *P. semipunctata* (unpublished data). The invasion of this second *Phoracantha* species will undoubtedly have effects on California's eucalyptus trees, but at this point the extent of the danger is not clear. *P. recurva* is attacked by the biological control agents that we have released against *P. semipunctata* (one egg parasitoid and three larval parasitoid species; Paine et al., 1995). Experiments are in progress to evaluate the impact of biological control on mixed populations of these two tree-killing eucalyptus borer species.

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PLANT PATHOLOGY HIGHLIGHTS

CHRYSANTHEMUM WHITE RUST, Chrysanthemum white rust residential survey activities began the week of April 2 in **Santa Cruz** County. Mike Maxwell, Agricultural Pest Control Specialist, reported the following survey information:

Properties surveyed (through 4/25):	859
Samples submitted:	1
Positive samples:	1
Properties with plants pulled:	2
Number of plants pulled:	7
Positive Find Properties:	1

Survey work started in the Green Valley area of Watsonville and ended in the La Selva area. Crews will continue in La Selva and move into Seascape and Aptos.

SIGNIFICANT FINDS OTHER STATES

Tomato Yellow Leaf Curl Virus (TYLCV). This virus was detected July 18, in Naples, Florida, by a University of Florida technician visiting a local retail home and garden center. The technician noticed symptomatic tomato transplants in the store's stocks. Tests confirmed the presence of TYLCV and plants were traced back to a Homestead, Florida, nursery.

Due to shortages of personnel, DPI, Florida Department of Plant Industry, explained that further survey of the disease at retail outlets would be done as time permits. Because shipments of infected plants may have gone to several states and countries, the shipments will be tracked and information gathered. Rigorous inspection for silverleaf whitefly is currently required for tomato transplants being shipped out of state. If whiteflies are detected, a permit is not issued.

LIFE CYCLE

In nature, TYLCV is transmitted by the silverleaf whitefly, *Bemisia argentifolia*. The whitefly transmits the virus in a persistent manner, meaning that once the virus is acquired it is retained in the insect for the remainder of its life cycle, as long as 10-20 days. The vector is present in the United States and was first reported infesting poinsettias in Florida in 1986, then subsequently spreading to vegetable crops. *B. argentifolia* has also been reported to occur in California on many crops. TYLCV is not seed transmitted and is mechanically transmitted only with difficulty in the laboratory. Flower drop is the main diagnostic symptom of infection not shared with related viruses.

The virus can be acquired by wingless larval stages. Because they are immobile, TYLCV-carrying larvae would only be imported on infected plant hosts of the virus. Importation of vegetative material of natural hosts of TYLCV (tomato, weedy *Datura* sp., *Acalypha* sp., *Malva parviflorum* and *Cyanchum aucutum*) is unlikely. Winged adult whiteflies can acquire the virus by feeding on TYLCV-infected tomato or weed hosts.

TYLCV is characterized by leaf curling, shortened internodes, thickened leaves, flower drop

and overall stunted growth. Fruit set before infection ripens normally, but additional fruit fails to set. If infected at an early stage, plants lose vigor and fail to produce marketable fruit.

In recent years, the silverleaf whitefly has become the dominant whitefly in the U.S., out competing the sweet potato whitefly. The silverleaf whitefly has a higher reproduction rate and feeds more heavily than the sweet potato whitefly. It takes 2-4 weeks, depending on temperature, for the egg to mature to an adult, occurring more quickly during periods of higher temperatures. Because of the broad range of reservoir hosts, both the vector and the virus can easily survive long periods of adverse conditions or inactivity. However, the vector could probably not overwinter in colder parts of the U.S.

CURRENT WORLDWIDE DISTRIBUTION

The virus was first characterized in Israel in 1939 where it has been a major limiting factor for tomato production. Other countries in the Mediterranean, Africa, Asia and Australia have reported related viruses. Prior to 1992, the virus had not been reported in the western hemisphere, when it was identified in tomatoes in the Dominican Republic. The disease spread quickly, and by the next year over two thirds of the 20,000 acres of tomatoes grown in the Dominican Republic had been affected by the virus. There are no known biological enemies of the whitefly in its normal geographic area.

AFFECTED HOSTS

While TYLCV has only been reported as a problem in tomatoes, it has a broad host range and infects several crop plants and weeds. The host range includes wild and cultivated plants from seven families. Crop plants include lentil, common bean, tobacco and tomato. The potential for greater impact on hosts in new areas is unknown.

The condition of the tomato plant that predisposes it to the whitefly is not known. The earlier the plant is infected, the more stunting and yield losses increase. Transmission of the virus does not appear to occur through seeds or casual contact with infected plants.

ESTABLISHMENT AND SPREAD

Virus non-host plant species such as poinsettia or cut flowers could be an important factor in spread of the disease, since the vector, *Bemisia argentifolia*, could migrate to them and then subsequently be imported in shipments of those crops. The source of infection in Florida is undetermined, but it is thought that viruliferous whiteflies may have been blown into Florida from Cuba or carried in on non-host plant material. The virus is present in Cuba, the insect vector carries the virus for as long as 20 days and the virus appeared simultaneously at several locations in southern Florida.

Symptoms appeared in March, corresponding to the end of the commercial cropping season when whitefly vectors might have been expected to move from harvested fields to transplant greenhouses. The Homestead area grows large quantities of ornamental whitefly hosts as well as tomatoes. The vector could increase its numbers during shipment of infected or non-infected plants. The virus can be found in vegetative parts of the plant while the whitefly is found on

the lower leaf surface where they feed on plant sap, mate and can lay up to 300 eggs.

Severe losses could result if this disease became established in Florida, where there 50,000 acres of field and greenhouse grown tomatoes and tomato transplants are grown. In 1991, the tomato crop was valued at $750 million. Tomato mottle virus, also transmitted by whitefly, caused an estimated $125 million loss in the Florida tomato crop in 1991, even though the symptoms are less severe than TYLCV.

In countries with Mediterranean climates, similar to that in California, TYLCV is the most devastating exotic virus problem affecting tomato crops. It could have a highly significant impact on the $836 million industry (1995 value) in California. The vector whitefly is present in California, outdoors only south of Fresno, but in greenhouses throughout the state.

TREATMENT

The pathogen itself is difficult to manage let alone eradicate. Treatment options include insecticidal control of whiteflies which would be difficult and expensive to maintain throughout an entire cropping season. Reservoir hosts, including weeds and other crop plants, can serve as an effective bridge between tomato growing seasons. While there are some tomato cultivars that are resistent to TYLCV, they were developed in the Mediterranean region and aren't well adapted to Florida growing conditions.

CALIFORNIA CONCERNS AND ACTIVITIES

Because of the impact this disease could have on the high value tomato industry in California, CDFA is monitoring the federal New Pest Advisory Group on TYLCV to determine if federal action against this pathogen will occur. CDFA is also in contact with the Florida Department of Agriculture and Consumer Services (FDACS) as they attempt to determine the source(s) of the infestation and identify any regulatory action that may result from this information. FDACS and USDA are working together to develop a management plan that will protect Florida growers and prevent further spread. CDFA will work with FDACS on establishing conditions for the shipping of tomato transplants, as needed, from pest-free greenhouse production facilities. Other possible pathways of TYLCV movement to California need to be identified, since the Homestead nursery shipped tomato plants to Puerto Rico and other offshore locations. CDFA will also conduct an initial survey of tomato production areas to see if the virus is already present, before taking major quarantine action. All incoming tomato plants can be monitored, but a 10-12 day latent period can occur before there are visible disease symptoms. It is expected that the virus will be introduced into California inspite of regulatory actions. A delay in its arrival will give researchers more time to develop TYLCV-resistant varieties and delay industry losses from the virus.

This information was taken from the USDA's New Pest Advisory Group draft report of August 4, 1997, and a fact sheet from Florida.

NEMATOLOGY HIGHLIGHTS

A brief review of the genus *Xiphinema* spp., the Dagger Nematode, with emphasis on *X. americanum*, *X. index* and *X. diversicaudatum* in California[1]

John J. Chitambar

Associate Plant Nematologist, California Department of Food and Agriculture

[1]This article is the first in a series to be published in CPPDR, prepared primarily for the Nematology Training Workshop offered by CDFA's Nematology Laboratory to California state and county participants.

The genus *Xiphinema* was first established by Cobb in 1913 when he discovered *X. americanum* in the rhizosphere soils of a variety of plants. The genus contains well over 60 species. The phytopathogenicity of most species is still unknown, however, of what is known, *X. americanum*, *X. index* and *X. diversicaudatum* are amongst the most economically important species internationally.

Distribution:

1. *Xiphinema americanum*: the American Dagger Nematode.

The species, *X. americanum* was taxonomically revised in 1979 by Lamberti & Bleve-Zacheo, and split into twenty-five closely related species. Currently, there are 34 species (20 of which are in North America), recognized in the "*X. americanum* group" (Robbins & Brown, 1991). This split would affect the distribution records of *X. americanum sensu lato* especially in California where it is stated to be commonly found. According to Lamberti & Bleve-Zacheo, the distribution of *X. americanum sensu stricto* is very limited, and appears to be restricted to the eastern part of north USA. These researchers state that (instead of *X. americanum sensu stricto*) a member (amongst others) of the *X. americanum* group, namely the species *X californicum*, is widespread throughout California, and associated with woody and herbaceous plants. The status of many of the closely related species, and the distribution of *X. americanum sensu stricto* is controversial and requires clarification. For all regulatory purposes, CDFA's Nematology Laboratory deals with the species in the broad sense as the *X. americanum* group. The information given here refers to the latter group.

Globally, *X. americanum sensu lato* is widely distributed. Records of its distribution include Poland, Australia, New Zealand, Chile, Mexico, UAR, USA, India, Sri Lanka, Europe, Pakistan, Guatemala and British Honduras.

The nematode is generally spread throughout the USA. It is likewise, widespread within California, especially in all grape growing areas and many stone-fruit orchards. According to CDFA Nematology Laboratory's detection records, *X. americanum* has been detected in the following counties over the past 9 years: Contra Costa, El Dorado, Fresno, Humboldt, Lake, Los Angeles, Mendocino, Merced, Monterey, Napa, Nevada, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Luis Obispo, San Mateo, Santa Cruz, Solano, Sonoma, Sutter, Tulare, Ventura and Yolo. *Xiphinema americanum* is rated a "C" pest by CDFA, warranting holding and control action administered at the county level.

2. *Xiphinema index*: the Califomia Dagger Nematode.

This nematode species is reportedly worldwide in its distribution. Its distribution is closely related to its main host, grapevine. Argentina, Chile, France, Germany, Greece, Hungary, Iran, Iraq, Italy, North Africa, South Africa, Tadzhikistan, Victoria, Poland, Portugal, Spain, Turkey and USA.

In USA, *X. index* has been reported in association with grapevines in California, Connecticut, Colorado, Kansas, Michigan, New Mexico, Oregon and Chiapas State, Mexico (Robbins & Brown, 1991).

In California, *X. index* was first discovered and described from Merced County in 1950. It is now widely distributed in the central valley south of Sacramento and throughout the northern coastal grape-growing regions. According to CDFA Nematology Laboratory's detection records, *X. index* has been detected in Fresno, Mendocino, Merced, Napa, Sonoma and Yolo Counties over the past 9 years. The California Dagger Nematode is a "B" rated pest in California, warranting holding, control or eradication action (where feasible) administered at the county level.

3. *Xiphinema diversicaudatum*: the European Dagger Nematode.

Xiphinema diversicaudatum was first found in soil samples from Austria. The species occurs mainly in temperate regions. It has been reported from several European countries: England, Scotland, Wales, Ireland, Belgium, France, Germany, Greece, Israel, Italy, the Netherlands, Poland, Portugal, Spain, Switzerland, the Yugoslavian island of Bisevo. It is also reported from Canada, USA, Australia, New Zealand, Guam and Argentina.

In North America, the species has been reported from: California, Connecticut, Illinois, Indiana, Maryland, Michigan, New Jersey, New Mexico, New York, Tennessee, Utah, Washington and Sonora State, Mexico (Robbins & Brown, 1991).

In California, *X. diversicaudatum* was found in two residential gardens in San Diego County in 1970, during an urban detection program. The nematode was also found in a rose cut-flower greenhouse in Alameda County in 1975. All three sites were treated with a soil sterilant and the nematode populations were apparently suppressed below a detectable level. Since then the nematode has not been reported from one residential site and the greenhouse site. The latter has since been replaced by residential property. Despite soil treatment (DBCP), Sims (retired, San Diego County Agricultural Commissioner's Office) continued to find the nematode in low

numbers in one residential garden until 1983. In 1994, Chitambar and Nolan (San Diego County) revisited the same site to find high population levels of the nematode species not only in the earlier surveyed backyard rose garden site, but also in frontyard rose rhizosphere soil.

Currently, there is no statewide detection program for *X. diversicaudatum* in existence, nor has there been one for over 20 years. *Xiphinema diversicaudatum* is an "A" rated pest warranting eradication, quarantine regulation or other holding action of established infestations.

Other species of regulatory importance in California include: *X. brasiliense* (rated Q), *X. chambersi* (Q), *X. setariae* (Q), *X. vulgare* (Q), *X. bakeri* (C), *X. brevicole* (C), *X. coxi* (C), *X. insigne* (C), and *X. vaittenezi* (C).

Hosts:

Xiphinema spp. are usually associated with woody hosts, however, they have also been found in association with herbaceous plants. They are common in such undisturbed sites as pastures, woody forests, orchards and vineyards.

Hosts of *X. americanum* include: strawberry, pear, peach, raspberry, cherry, grapevine, maize, soybeans, oats, wheat, lucerne, flax, forage legumes, maple, sycamore, forest evergreens, pine, maple, spruce, sugarcane, citrus, orange, grapefruit, mango, coffee and ornamentals.

Xiphinema index is closely associated with grapevine throughout the world. Other hosts include fig, rose, mulberry, prune, apple, pistachio, citrus, Boston ivy, Virginia creeper, sour orange, bur marigold, dwarf nettle, strawberry, tomato, walnut, cactus, fruit trees and ornamentals.

Some hosts for *X. diversicaudatum* include rose, grapevine, strawberry, raspberry, hedgerows, hops, apple, asparagus, cabbage, carrot, cherry, clover, peach, pine, tamarillo.

Biology:

Xiphinema spp. is an ectoparasite genus inhabiting the rhizosphere soil of its host plants. The biology of *X. index* has been studied in more detail than *X. americanum* and *X. diversicaudatum*. The life cycle of *X. index* is completed in 22-27 days at 24 °C in California. Eggs are laid singly in the soil, and hatch in 6-8 days. A population may be generated by a single larva. Longer life cycles are reported from Italy (7-9 months at 20-23 °C). On the other hand, *X. americanum* takes at least one year to complete its life cycle, and *X. diversicaudatum* may take 3 years from egg to egg. While *X. diversicaudatum* and *X. index* have four larval stages in their development, Alkemada and Loof in 1989 reported only three larval stages for some North American *X. americanum* group species. Usually, reproduction is by parthenogenesis, except for *X. diversicaudatum* where it is sexual. Males are rare and are found in low numbers. Rarely are males numerous due to adverse environmental conditions.

The optimum temperature for reproduction for *X. americanum* is 20 °C and 24 °C on tomato and strawberry respectively, 29.4 °C for *X. index*, and the mean rate was 7.3 larvae per year for *X. diversicaudatum*. In the absence of its host, *X. diversicaudatum* can survive in soil without multiplying for at least 3 years. *X. index* survived in moist soil without food up to 9 months.

Xiphinema americanum declines in numbers under low and high moisture levels, as well as in potted soil irrigated irregularly, thus making it very difficult to culture in the greenhouse. This species is very sensitive to low diffusion rates of oxygen in the soil.

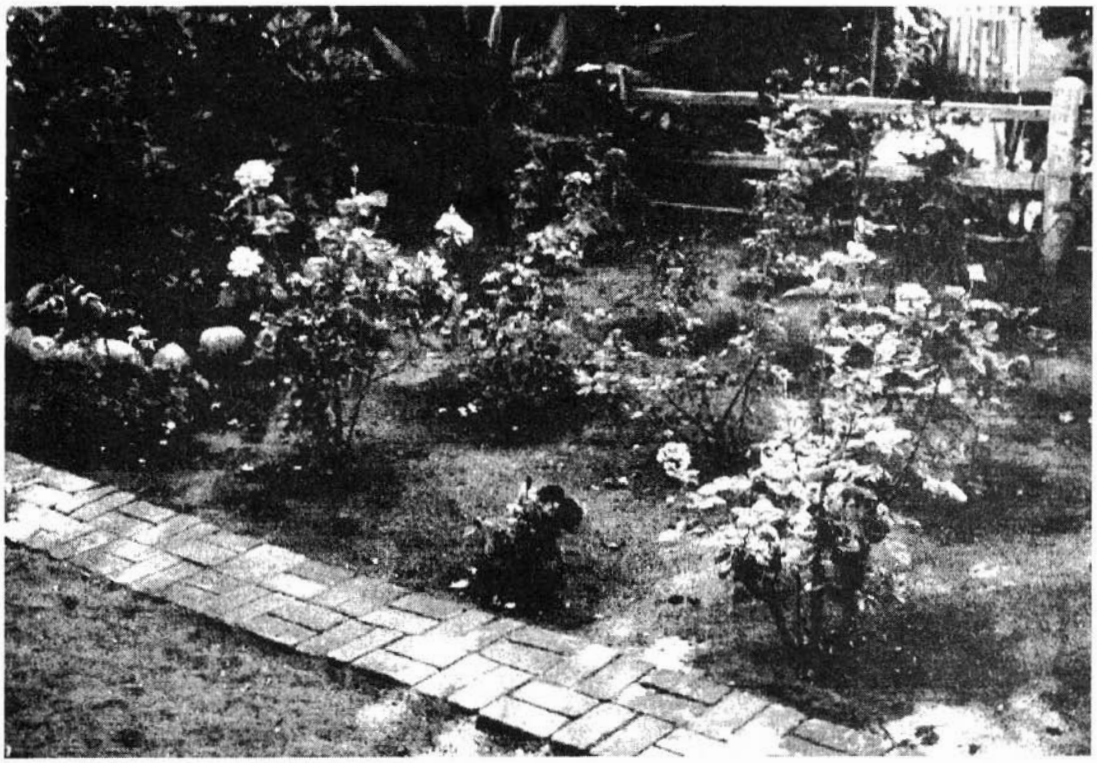

Figure 1. Rose plants affected by *Xiphinema diversicaudatum*: stunted plant growth.

Symptoms:

X. index: symptoms on roots are 1) terminal swellings with necrosis, 2) cessation of root elongation and extensive necrosis of main roots resulting in a witch's broom effect from lateral proliferation, 3) unequal swelling on one side of rootlets, which produces a curvature or bending of 45-90 degrees or more (Raski & Krusberg, 1984). The nematode may feed at the root tip or in the piliferous region, however, galls are produced only at the tip (Fisher & Raski 1967). Above ground symptoms on foliage or fruit are not diagnostic and may not even be present.

X. americanum: stunted root growth and absence of feeder roots. Occasional distortion of roots. Root galling and necrosis does not occur, as in *X. index*.

X. diversicaudatum: often root tips are galled, and small, localized necrotic lesions are formed at the feeding site. Heavy nematode infestations may reduce the vigor of small herbaceous plants, however, plants with larger root systems do not exhibit any apparent symptoms above ground.

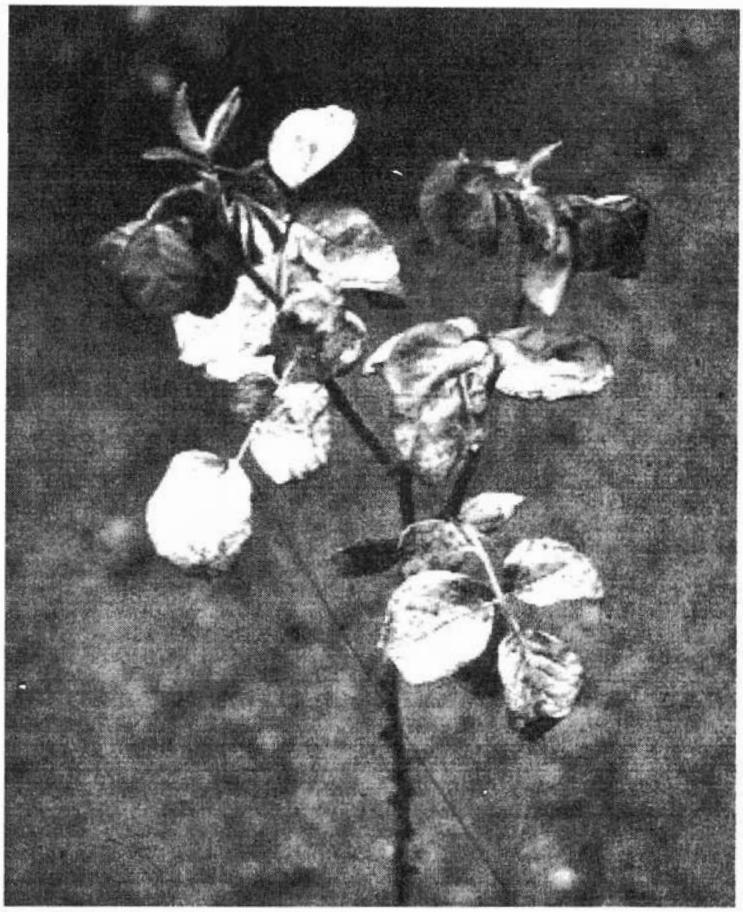

Figure 2. Above ground symptoms of *Xiphenema diversicaudatum* on rose.

Virus vectors:

Some *Xiphinema* spp. have the capability of vectoring viruses to their host plants. *Xiphinema index* was the first nematode proven to vector a plant virus. *Xiphinema* spp. (as also *Longidorus* spp.) transmit Nepoviruses, which are polyhedral, isodiametric particles approximately 30 nm in diameter. Four species vector viruses to grapevine: *X. index, X. americanum sensu lato, X. diversicaudatum* and *X. italiae. Xiphinema americanum* vectors the following viruses: tomato ringspot (grape yellow vein virus strain) to herbaceous plants, peach, apricot, plum; cherry rasp leaf curl to *Chenopodium amaranticola* and *C. quinoa*; necrotic ringspot to blueberry; ash strain of tobacco ringspot. *Xiphinema index* vectors grapevine fanleaf virus. *Xiphinema diversicaudatum* vectors arabis mosaic virus to a range of agricultural crops and weeds.

Sampling:

Xiphinema spp. is a root ectoparasite. Collect soil from the root zone of the plants. Include roots for laboratory examination. In field situations, as in a vineyard, collect soil samples from the area where roots and nematodes are undisturbed by cultural operations. Trees should be sampled at the dripline where the feeder roots are found. In potted plants, collect soil from the inner ball of roots within the pot. Composite sample. Send at least one quart of soil and some roots to the Laboratory.

Extraction:

Xiphinema spp. can be separated from soil by sieving the soil-water suspension. The large species, *X. index* and *X. diversicaudatum* can be caught on a 60 mesh sieve, while smaller *X. americanum* can be collected on 300-500 mesh sieves. The backwashed sieve residue from a 60 mesh sieve can be examined directly for the nematodes, or all sieve residues may be processed further to obtain a cleaner suspension of nematodes. Further processing is done using Baerman funnel, mist chamber, or sugar centrifugation techniques.

Figure 3. Galled rose roots caused by *Xiphinema diversicaudatum* (by permission: Florida Department of Agriculture).

Diagnostic morphology of the genus *Xiphinema*:

Female: Slender nematodes, 1.5-5 mm long. Lip region continuous or offset. Amphid apertures a broad slit leading internally to a funnel-shaped pouch. Stylet (odontostyle) elongate (60-250 μm) with a forked base, and long extensions (odontophore) bearing three basal flanges. Guiding ring located near the base of styles. The esophagus begins as a slender, coiled tube which expands to form an elongate, cylindrical basal bulb (like a bottle with a long, narrow, curved neck). Dorsal esophageal gland nucleus at extreme anterior end of bulb. Prerectum present. Ovaries one or two. Vulva at mid body, or anterior to it.

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